A pumping and tracer test in a limestone aquifer and impacts on contaminated site risk assessment and management

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Jeg har forslag til *(sæt kryds)*	__ Temadag 2017, 6. marts *(heldagsmøde om et givent emne – her bedes du også indikere en skitse til et program)* _x_ Et indlæg jeg gerne vil holde på Vintermødet 2017, 7. – 8. marts *(et 20 min. indlæg som en del af det samlede program)* __ En fagsession jeg gerne vil arrangere på Vintermødet 2017, 7. - 8. marts *(flere sammenhængende indlæg om et specialiseret emne – her bedes du endvidere indikere en programskitse)* __ En workshop jeg gerne vil arrangere på Vintermødet 2017, 7. – 8. marts *(korte oplæg – aktiv deltagelse af deltagerne – her bedes du endvidere indikere en programskitse)* __ Forslag om andre foredragsholdere eller emner til sessioner
Titel på indlæg	Pumpe og tracer forsøg i et kalkmagasin, og betydning for risikovurdering og forvaltning af forurenede grunde (Foredraget holdes på Dansk) A pump and tracer test in a limestone aquifer, and implications for contaminated site risk assessment and management
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Målgruppe *Hvem er den primære målgruppe?*	Contaminated site case officers at the Regions, consultants, academics, kommunes (pump test)
	/fortsættes

Titel på indlæg *(gentages fra side 1)*	**A pumping and tracer test in a limestone aquifer and impacts on contaminated site risk assessment and management** Pumpe og tracer forsøg i et kalkmagasin, og betydning for risikovurdering og forvaltning af forurenede grunde
Baggrund / indledning	Region H has worked with DTU Environment for 3 years on a project to improve our understanding and practical management of contaminant transport in limestone aquifers. The project includes an extensive field campaign, and makes extensive use of models for conceptual understanding, experimental design, and for interpretation of results.
Formål Hvad er formålet? Hvorfor er det relevant for tilhørerne? Hvad kan vi lære?	To conduct a field pump and tracer test at a contaminated site at Akacievej, Hedehusene in order to improve our understanding and practical management of contaminant transport in fractured limestone aquifers.
Metoder og datagrundlag F.eks. laboratorie-, pilot- og/eller feltundersøgelser eller modellering samt antal analyser, boringer, transekter, offentlige administrative aspekter, erfaringsopsamling mv.	A hydraulic pump test was conducted with a simultaneous tracer test (Figure 1). Before the pump test, the geology was carefully mapped using borehole cores, geophysics etc. The pump test was conducted over several weeks, with head observations being collected at a set of observation wells at different depths in the aquifer. Different tracers were injected at several observation wells and monitored at the pumping well. The experiment was designed and results interpreted using a 3D fracture transport model.
Resultater Hvad er interessant? Hvilke sammenhænge ses? Hvordan passer det med det forventede? Osv.	The pump and geologic investigations test showed that limestone aquifers are very permeable, with fracture flow dominating the hydraulic response. The tracer test showed very fast (minutes) breakthrough, suggesting a very high degree of connectivity between wells. Significant tailing showed that limestone matrix diffusion is important for interpretation of results. When tracers are injected for a period before pumping, they diffuse more into the matrix, resulting in lower breakthrough concentrations and longer tailing of concentrations. Deeper wells and crushed upper layers have lower permeability and show slower breakthroughs.
Konklusion Vigtigste læringer – her oplistes de punkter, som du mener, at tilhørerne kan lære noget af – altså "take home messages"	A pump test and tracer test was conducted and allowed for new and improved understanding of limestone aquifers: • Analyses of contaminant transport in limestone aquifers must consider fast transport pathways in fractures and exchange of contaminants between the limestone fractures and matrix. Limestone aquifers cannot be considered to be porous media. • Well capture zones are very hard to map in such aquifers. • Remediation of limestone aquifers will be difficult because it is hard to remove contaminants from the limestone matrix. • While tracer tests show extremely fast breakthrough of contaminants, plume speeds are much slower because of contaminant migration into the limestone matrix when contaminants are present in aquifers for longer times. These factors are incorporated in an improved risk assessment for the site.
Tidshorisont Evt. igangværende projekt-resultater og konklusioner skal foreligge inden Vintermødet 2017	The pump and tracer test was concluded in the spring of 2016. Model interpretation was completed in the fall of 2016.

Andre bemærkninger	Foredraget holdes på dansk. Indlægget kan med fordel kobles sammen med den indsendt af Annika S. Fjordbøge: Dynamisk udvikling i fordelingen af opløst PCE i sprækket kalkmagasin ved ændrede pumpningsforhold og udvikling af konceptuel model
Illustration Indsæt gerne illustrerende figur, som viser resultater, proces eller lignende, som side 3	

Figure 1. Integrated field and modelling approach to conducing a pump and tracer test at Akacievej, Hedehusene